himself playing the adversary as his predecessors did. He said he could not think of a single agency or person with whom he had to do battle. He did not know whether this reflected on his personal style, or on Carter's style of governing.

Press and his associate, Smith, said that the abolition of the standing advisory committee made no significant change in the way they communicate with the outside world. "We get 100 calls a day in this office," Press said, and a lot of free advice. The OSTP keeps a roster of 200 consultants from whom it seeks specialized advice. The system differs very little in practice, Smith said, from the methods used in earlier years.

Press said that his chief statement of policy is his effort to increase the federal investment in basic research. One might not guess it from the senatorial rhetoric, but this policy is by now familiar to Congress, and not entirely welcome. In part, the resistance stems from the fact that the increase in basic research funding is being made at the cost of funding for demonstration projects. Industries that thrive on demonstrations do not necessarily thrive on research, and for this

Holoart: Playing with a Budding Technology

As the 20th century advances, the flirtation of art with advanced technology has become more pronounced, as in computer-generated pictures and electronic music. Much of this is not particularly successful, for the more complex the technology the more skill is required to bend it to the will of the artist. Too often, it is the technology and not the art that becomes the message.

Holography, the technique of creating three-dimensional images with light, has over the past decade become a medium that holds considerable fascination for a small number of artists in this country and abroad. "Holoart," as it has been called, has about 200 practitioners in this country, and their efforts are being reinforced by New York's Museum of Holography, which opened at the end of 1976.

Last month the museum, located on Mercer Street in Manhattan's Soho district, was the setting for a daylong seminar on "Holographic art: policies for a new art form," at which people connected with various aspects of the arts discussed questions that included: "Is holography an art form?" (it certainly can be and in some cases is), "What's unique about it?" (it can do things nothing else can), and "How do we get money to support it?" (with difficulty).

As a technology, holography has not yet matured despite the elaborate visions some had for it in the 1960's. The technique was developed in 1948 in England by Dennis Gabor, who won the Nobel Prize in physics for it in 1971. Briefly, it entails splitting a coherent light beam into two beams, one aimed at the object and one at a photographic plate or film. The light reflected from the object and the beam aimed at the plate meet at the plate, where they create an interference pattern. When a coherent light beam is later shone through the plate, the image of the object is created in three-dimensional form. Research on holography received its impetus with the development of lasers in 1960. In 1962 Emmet N. Leith and Juris Upatnieks of the University of Michigan created the first holograms with lasers. There was big talk in the 1960's about the potential for holograms—particularly in advertising and displays—and holographic television, which would make the set look like a tiny stage, was seen as a tantalizing possibility.

But even as the failure of exaggerated expectations in view of the limitations of the medium caused research in holography to subside in the early 1970's, artists were developing an interest. In 1968, Stephen Benton of Polaroid Research Laboratories developed a way to reconstruct holographic images by use of white light (such as that from an ordinary light bulb) instead of laser light, which made display much easier. Others figured out how to reduce the high cost of equipment for making holograms with homemade "vibration isolation tables" (a hologram has to be made on an absolutely still surface because movement of even one-fourth of a light wave can destroy the process) and cheaper optics. The medium was expanded with the development of pulsed lasers that have infinitesimal exposure time, useful for live subjects or outdoors, and methods for transforming a film of a moving object into a three-dimensional image that moves as the viewer circles the display.

There is still much technical work to be done to make the medium as versatile as artists might wish. One impediment is scale—a holographic image can be no larger than the plate that contains the information—and a major challenge is the development of holograms that reproduce the original colors. A laser, transmitting light of the same wavelength, produces a monochromatic image; holograms illuminated with white light have blurry horizontal "rainbow" stripes because of the different frequencies.

A look at the holograms in the museum reveals an art form still in a rudimentary stage—founder and director Rosemary Jackson compared it to the daguerreotype phase of photography. The transparent holographic film is bent around a black background; one looks through the film, which is illuminated from below, and perceives images floating in space behind it. There were landscapes, dancers, computer-constructed forms, and a few surrealistic effects achieved by putting physical objects in the space behind the film which appeared to blend with the holographic image. Some of the images were blurry and disappeared instantly if they were not looked at from the right angle.

Holoart is a case of people attempting to combine an infant technology with an embryonic aesthetic, the artistic potential of which has scarcely been enunciated much less realized. Asked what was so unique about it, the artists at the meeting could say no more than that it does things that are impossible with any other medium. One particularly striking hologram, in England, is said to be a 3 by 5 foot image of a gun shooting a bullet through glass. Done with a pulsed laser, it captures the bullet in midair and a plume of gunsmoke issuing from the muzzle.

Experimental as the form is, holoart creates enormous interest wherever it is shown. According to Jackson, 200,000 people have visited the museum since its founding, and thousands flock to exhibits that have been sent around the country. It may be even more interesting as science than as art, for it illustrates principles that ordinarily have to be taken on faith. For example, it vividly demonstrates

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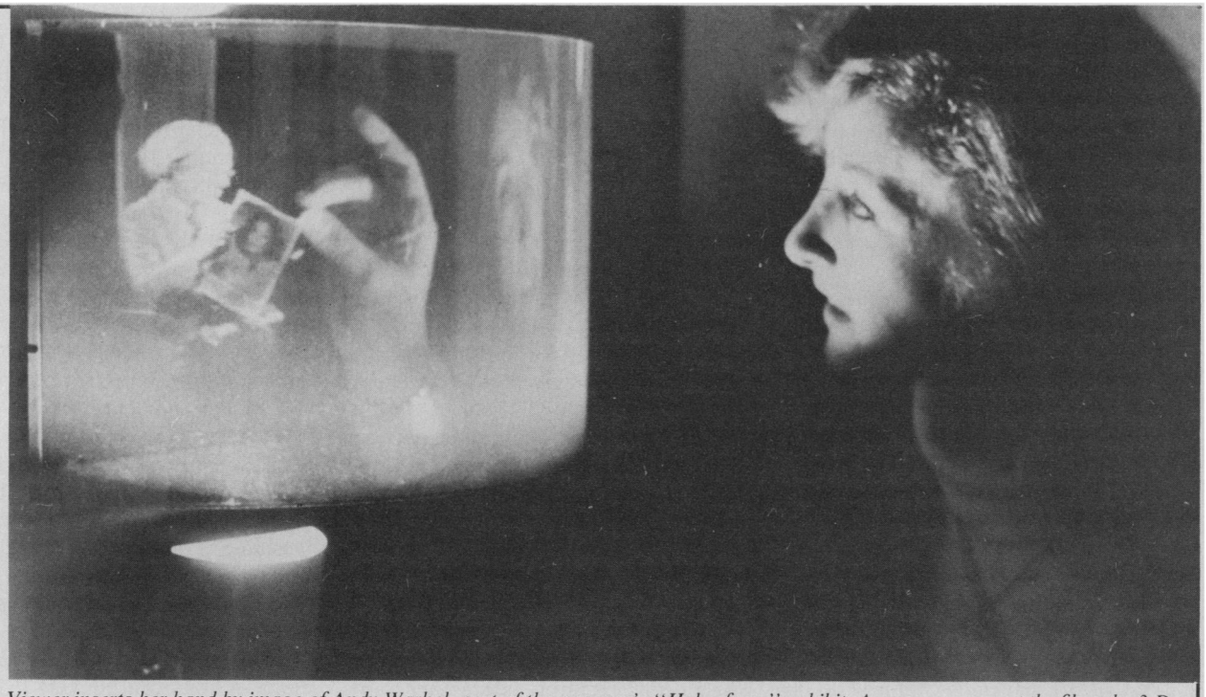
reason they see a flaw in the new policy.

In the oversight hearing on 21 March, Senator Schmitt suggested that it might be a mistake for the government to reduce its support for major demonstration projects. There may not be enough private capital to take up the slack, he said. Press disagreed, saying that the year-end profit reports for 1978 show that the problem is not a lack of private capital, so much as a lack of willingness to invest it. He did not agree that the government should use it scarce resources in 1980 to support developmental projects.

Stevenson's aides also have criticized the OSTP for being overly cautious with federal funds. They hold Press responsible for the Administration's decision not to push for a more rapid development of commercial ventures in space.

These complaints are much more substantive, although less clearly articulated, than the complaint that Press is devoting less time than he should to "institution building." They suggest that the real measure of Press's leadership will not be in the quality of his next annual report, but in his ability to defend the budget against congressional tinkering.

—ELIOT MARSHALL



Viewer inserts her hand by image of Andy Warhol, part of the museum's "Hol-o-fame" exhibit. As one moves past the film, the 3-D Warhol turns a page of the magazine.

that vision is an illusion, in that what the brain perceives are not objects but the light reflected from objects. It also demonstrates the different wavelengths of colors: according to Rick Silberman, a holographer at Brown University, an image made with a blue laser will appear smaller than the same image made with a red laser, because blue wavelengths are shorter than red ones. A hologram is also about the only way two objects can appear to occupy the same three-dimensional space at the same time.

Just as major scientific concepts such as relativity theory and the uncertainty principle have had an impact on all of 20th-century thought, some people believe holography can have an impact on the way we perceive the world. Brain researcher Karl Pribram of Stanford University, for example, has seized upon the hologram as a metaphor for the way the brain processes information. According to Pribram, the brain, like a hologram, performs an analysis of visual information and then projects an image into space. Another feature in common is redundancy. Just as memory and perception appear to be distributed around the brain—as evidenced by the fact that destruction of certain parts of the brain does not impair its function—so all the information in a hologram is contained in every part of it. This is because in holography, which is sometimes referred to as lensless photography, there is no focusing device, so light waves from all parts of the object hit all parts of the plate.

In a way, holography is an exciting new toy that no one quite knows how to make the best use of. So far, it has only one well-established commercial application—in nondestructive vibration testing of materials such as jet engines, where it can detect vibration that is indiscernible by other means. Many other uses are now being explored, as in creating displays of instrument panel readings over the window of an airplane cockpit so the pilot does not have to look down, and in holographic computer storage. In the longer term there is talk of holographic video telephones, and in the wilder realm are notions such as projecting the holographic image of a police car at a busy street corner.

Meanwhile, holartists are still trying to figure out how to get money to pursue their calling. Of some 200 holographers in the country, only four have managed to get grants. Others are regularly turned down—by the National Science Foundation because they are too arty, and by various art supporting agencies because they do not fit into any existing category. Private collectors stay away from holograms because as yet they are not regarded as an "investment." In some ways, the frustration is like that of scientists who want money to test a new hypothesis. Seed money is the most desperately needed kind, but holders of purse strings do not want to take risks on something whose promise is not yet proved.—CONSTANCE HOLDEN